

What is Claimed:

- 1 1. An apparatus for rolling a luminal graft into a low profile configuration,
2 comprising:

3 two cylindrical rollers rotationally mounted on parallel axes;

4 a continuous belt disposed on said rollers to form an inner loop
5 defining a pocket and an outer loop circumscribing said rollers and said inner loop;

6 a mandrel disposed within said pocket to maintain said pocket and
7 press said graft against said belt; and

8 a tensioning device, applying tension to said belt.
- 1 2. The apparatus of claim 1 wherein said mandrel comprises a floating cylindrical
2 pin.
- 1 3. The apparatus of claim 2 wherein said tensioning device comprises a
2 removable tension rod positioned within said pocket, pressing said mandrel toward
3 said belt and pinching said graft against said mandrel.
- 1 4. The apparatus of claim 1 further comprising a spring biasing said rollers
2 toward each other.
- 1 5. The apparatus of claim 2 wherein said tensioning device comprises a spring
2 biasing said outer loop of said belt.
- 1 6. The apparatus of claim 1 wherein said mandrel is a portion of a delivery
2 system for said graft.
- 1 7. The apparatus of claim 6 wherein said mandrel is a catheter.
- 1 8. The apparatus of claim 6 wherein said mandrel is a guide wire.

1 9. The apparatus of claim 3 further comprising a frame configured to position
2 said axes of said rollers and to restrain said starter rod.

1 10. The apparatus of claim 9 further comprising a crank for rotating one of said
2 rollers.

1 11. The apparatus of claim 10 wherein the said crank comprises an electric motor
2 rotating upon its axis when triggered by a switch for compression and loading of
3 said graft.

1 12. The apparatus of claim 1 further comprising a graft tension rod positioned in
2 contact with the inner surface of said graft to maintain uniform tension along the
3 length of said graft.

1 13. The apparatus of claim 12 wherein said graft is bifurcated having a first and
2 second leg with a common trunk, and wherein said tension rod is positioned in
3 contact with the inner surface of said trunk and said first leg to maintain uniform
4 tension along the length of said trunk and said first leg, the apparatus further
5 comprising a second tension rod positioned in contact with the inner surface of said
6 second leg to maintain uniform tension along the length of said second leg.

1 14. The apparatus of claim 2 wherein said mandrel further comprises a removable
2 lock for fixing said graft to said pin.

1 15. The apparatus of claim 13 wherein said pin is configured to have an undercut
2 diameter along a portion of its axial length to accommodate said graft and wherein
3 said lock comprises fingers restraining a portion of said graft in said undercut
4 diameter.

1 16. A method of rolling a luminal graft into a low profile configuration, comprising
2 the steps of:

3 positioning a mandrel in contact with a surface of said graft;

4 placing said mandrel and a portion of said graft proximate a belt
5 disposed on two essentially parallel cylindrical rollers;

6 positioning said rollers to form a pocket in said belt to retain said
7 mandrel and said portion of said graft;

8 applying tension to said belt; and

9 rotating one of said rollers to roll said graft onto said mandrel.

1 17. The method of claim 16 further comprising the steps of:

2 introducing a temporary covering between said rollers after said graft is
3 rolled onto said mandrel; and

4 continuing to rotate one of said rollers to roll temporary covering onto said
5 graft.

1 18. The method of claim 16 wherein tension is applied to said graft while it is
2 rolled onto said mandrel.

1 19. The method of claim 16 wherein said graft is a bifurcated graft having a main
2 body in communication with two limbs, and said limbs are folded inside of said main
3 body prior to rolling said graft onto said mandrel.

1 20. The method of claim 16 wherein said tension is applied to said belt by placing
2 a tension rod into said pocket external to said graft.

1 21. The method of claim 16 wherein said tension is applied to said belt by a
2 biasing device acting on said belt.

1 22. A rolled graft, comprising a generally tubular graft flattened against itself and
2 rolled onto itself into a cylindrical configuration.

1 23. The rolled graft of claim 22 further comprising an aperture extending along
2 the axis of said cylindrical rolled graft.

1 24. The rolled graft of claim 22 wherein said graft is rolled onto an axial member
2 comprising a part of a delivery system by which said graft is deployed in a body
3 lumen.

1 25. The rolled graft of claim 22 in combination with an expansion element
2 disposed axially within said rolled graft.

1 26. The rolled graft of claim 22, wherein said graft includes a larger diameter
2 main section and two smaller diameter sections at an axial end of said larger
3 diameter section.

1 27 The rolled graft of claim 22 further comprising a temporary covering
2 surrounding and restraining said graft in said cylindrical configuration.

1 28. The rolled graft of claim 27 wherein said temporary covering comprises
2 perforations along its length, such that said temporary graft tears along said
3 perforations when radially outward force is applied to said rolled graft.

1 29. The rolled graft of claim 27 wherein said temporary covering is absorbed after
2 delivery into a body lumen.

1 30. The rolled graft of claim 27 wherein a flexible member is embedded in said
2 temporary covering to fail said temporary covering after delivery into a body lumen.

1 31. A graft kit, comprising:

2 a low profile delivery system configured to deliver a rolled graft
3 endoluminally; and

4 a plurality of differing grafts, each being compatible with a low profile delivery
5 system, for selection of an optimal one of said plurality during a surgical procedure

6 at least one of said grafts comprising a low profile delivery configuration in
7 which the graft is wrapped axially about itself.

1 32. The kit of claim 31 further comprising an apparatus for rolling a selected one
2 of said grafts into a low profile configuration for endoluminal delivery.

1 33. The kit of claim 31 wherein all of said grafts are rolled grafts.

1 34. An endoluminal graft delivery system, comprising:

2 a member configured to be advanced through a body lumen from an access
3 to a location remote from said access; and

4 a graft rolled on its longitudinal axis into a low profile rolled graft
5 configuration over said member and radially constrained on said member during
6 advancement through said body lumen.

1 35. The delivery system of claim 34 wherein said graft is permanently attached to
2 a self-expanding stent associated with said member.

1 36. The delivery system of claim 34 wherein said member is a guide wire.

1 37. The delivery system of claim 34 wherein said member is a catheter.

1 38. The delivery system of claim 34 wherein said member is a self-expanding
2 stent.

1 39. The delivery system of claim 34 wherein said member is an expandable stent.

1 40. The delivery system of claim 34 wherein said member is a combination of one
2 or more of a guide wire, a catheter, and a stent.

1 41. The delivery system of claim 34 wherein said graft is radially constrained by a
2 sheath, which is axially withdrawn to release, said graft.

1 42. The delivery system of claim 34 further comprising an expansion device
2 disposed radially within said rolled graft.

1 43 The delivery system of claim 42 wherein said expansion device is a balloon.

1 44. The delivery system of claim 42 further comprising an inner sheath disposed
2 between said expansion device and said rolled graft, said inner sheath being axially
3 movable relative to said rolled graft.

1 45. The delivery system of claim 34 wherein said rolled graft is radially
2 constrained by a temporary covering during advancement through said body lumen.

1 46. A method for delivering a luminal graft into a body lumen comprising the
2 steps of:

3 rolling said graft upon itself into a low-profile rolled configuration;

4 restraining said graft in said rolled configuration;

5 endoluminally delivering said graft into a body lumen; and

6 applying radially outward force to said graft to expand said graft into a
7 tubular, deployed configuration.

1 47. The method of claim 46 wherein the step of restraining said graft comprises
2 applying a temporary covering surrounding said graft in said rolled configuration.

1 48. The method of claim 47 wherein said temporary covering comprises
2 perforations along its length, and said radially outward force causes said temporary
3 covering to tear along said perforations.

1 49. The method of claim 47, further comprising, prior to the step of applying
2 radially outward force, the step of releasing said temporary covering.

1 50. The method of claim 49 wherein the step of releasing said temporary covering
2 comprises allowing said temporary covering to be absorbed into the body.

1 51. The method of claim 49 wherein the step of releasing said temporary covering
2 comprises pulling a rip cord or ribbon to fail said temporary covering.